

Waste Tank ISI Summary



We Put Science To Work

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Tank Inspection Abstract

- Inspection of high level waste storage tanks is a critical component of stewardship. Inspection provides real-time assessment of actual conditions and is required to maintain safe storage of highly radioactive waste. MS&T lead the team that developed the In-Service Inspection Program for HLW tanks which was implemented and became a contract deliverable with DOE. The first round of inspection has been completed. We now have in-service thickness data on all Type III/IIIA tanks. Tank 15, a Type II tank with known Stress Corrosion Cracking was also inspected for a second time providing a comparison of cracks from 2002 to the conditions in 2007. Tank inspection methodology and NDE results will be presented as well as planned future inspection activities.

Comprehensive Inspection Program

- Visual Surveillance
 - Still photography – (5,945 photos in 2007)
 - Wide Angle
 - Direct
 - Video Camera Inspections (over 1221 visual/video exams in 2007)
- Historical UT spot readings (~24,000 measurements over 14 years 70's & 80's)
- ISI Program (NDE)
 - Thickness mapping, pit and corrosion detection
 - Crack detection
 - Weld inspection

Tank Inspection Summary

■ Status

- SRNL developed ISI program implemented successfully
- DOE contract deliverable milestones met on time/on schedule
- All 27 Type III tanks inspected with new program
- Tank 15 inspected twice

■ Results

- Type III tanks in very good condition
- Incipient pitting, but no actionable indications.
- Reportable thickness in Primary and Secondary walls
- Tank 15 - Crack growth perpendicular to the weld. No reportable thinning or pitting after 48 years. (entered service in 1960)

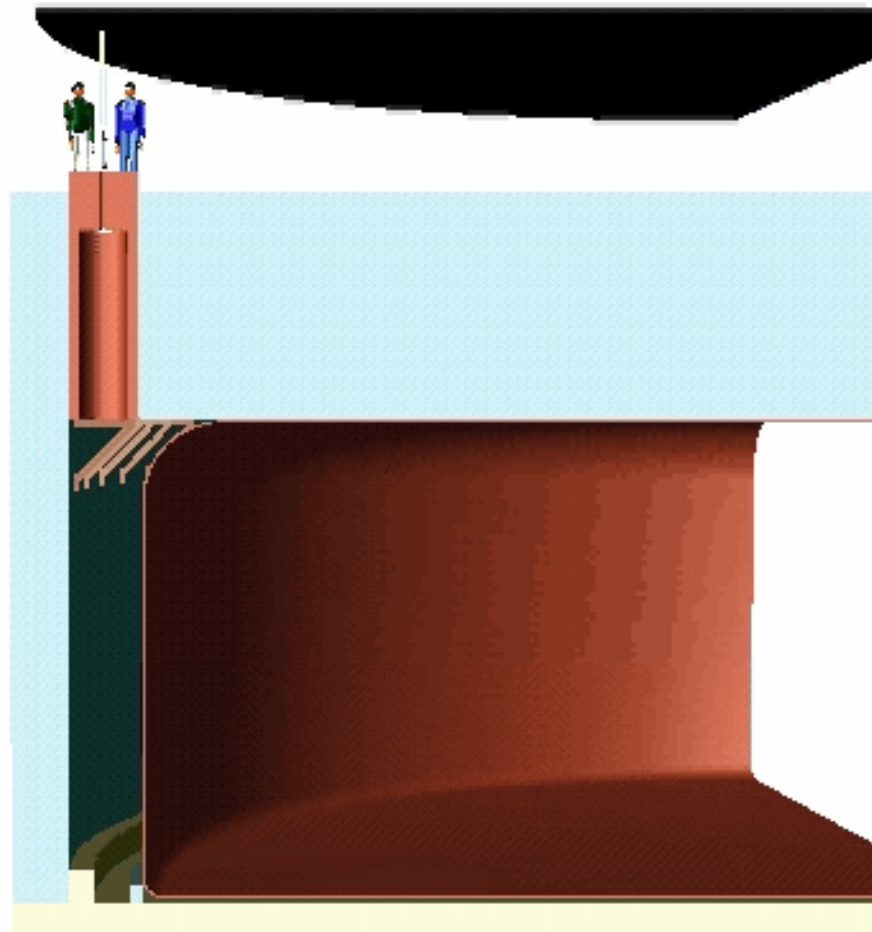
NDE Results Summary

In the areas of the 27 Type III tanks inspected to date, ten tanks have reportable thickness in the primary wall and 17 have reportable thickness in the secondary tank walls or floor. All of the reportable thickness areas in the primary walls are from fabrication artifacts. Incipient pitting has been detected in five of the 27 Type III primary tanks. No cracking was detected in any of the areas examined in the Type III tanks

Tank Inspection Summary

- Path forward
 - Develop techniques to inspect previously inaccessible areas
 - Define tanks to be monitored and frequency
 - Key roles in tank closure
 - Inspection (Pre / Post cleaning)
 - Salt removal

Animated Demonstration [Video](#)



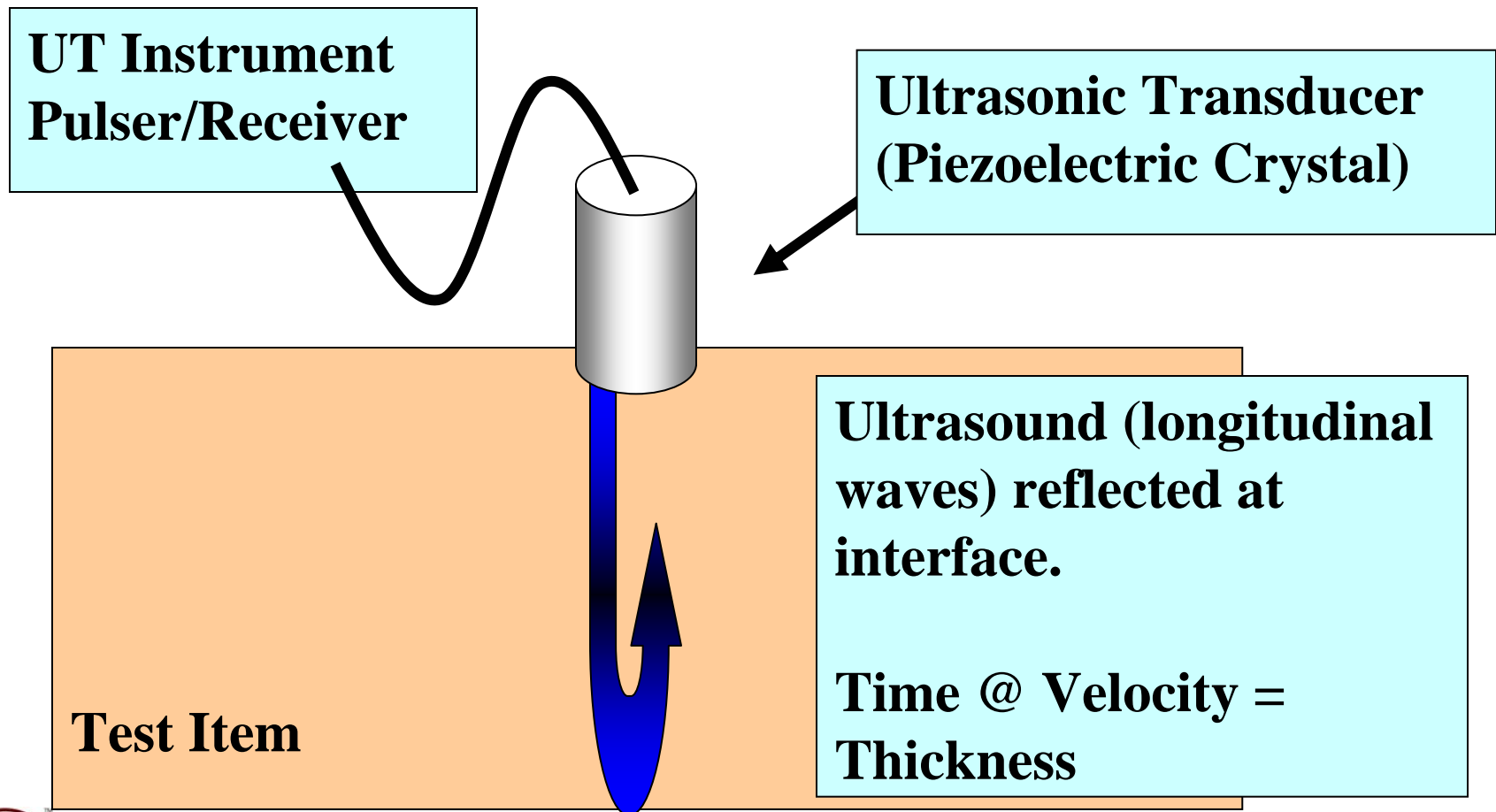
Inspection Technique Summary

- NDE inspections included remote automated ultrasonic (AUT) inspection supplemented by remote visual inspection. Ultrasonic inspections included the following techniques:
 - Thickness Mapping
 - Weld Inspection/Crack Detection
 - Ultrasonic Flaw Sizing
- Remote visual &
- Though-wall bleed out

NDE Inspection Equipment – Field Operation

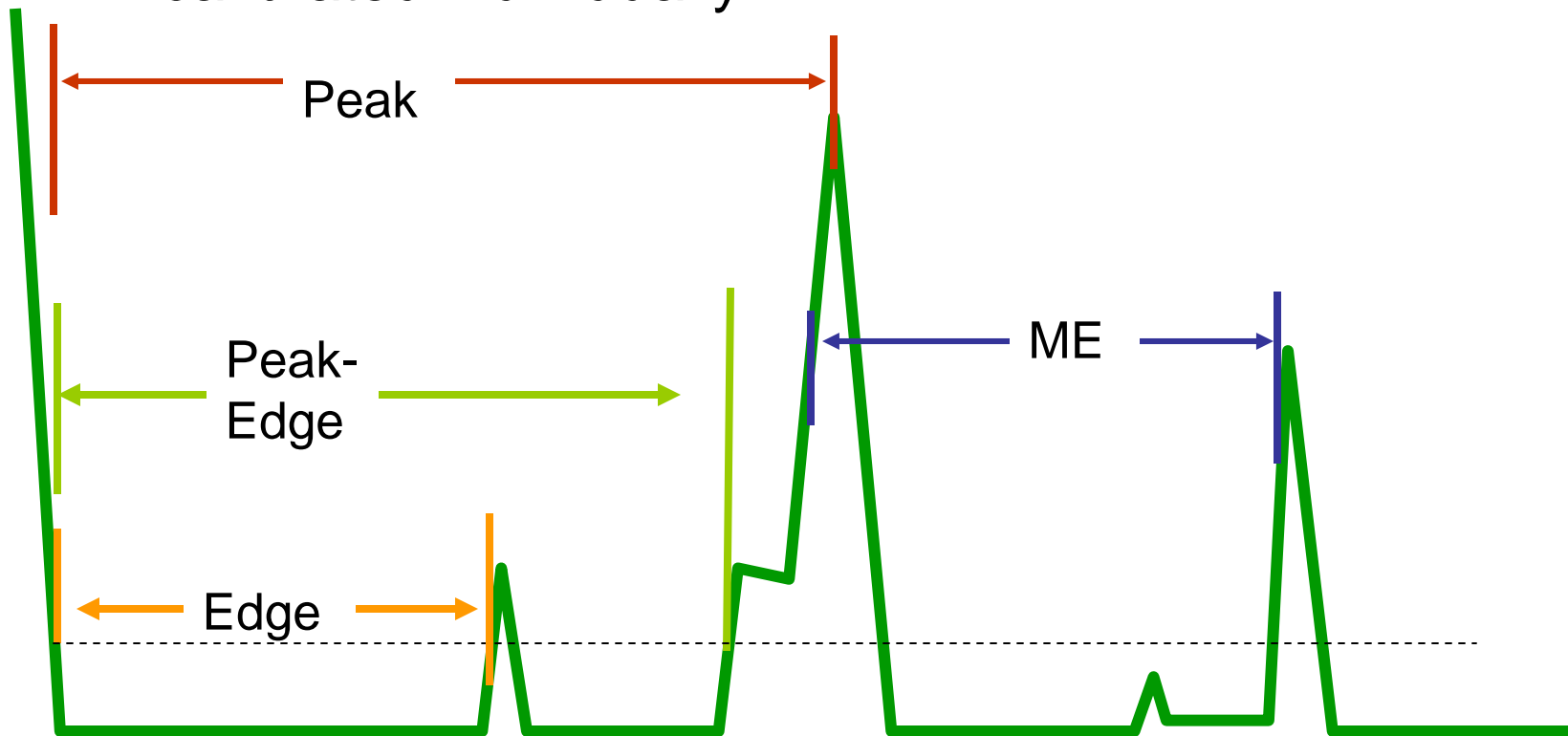


Basic Theory - UT Thickness



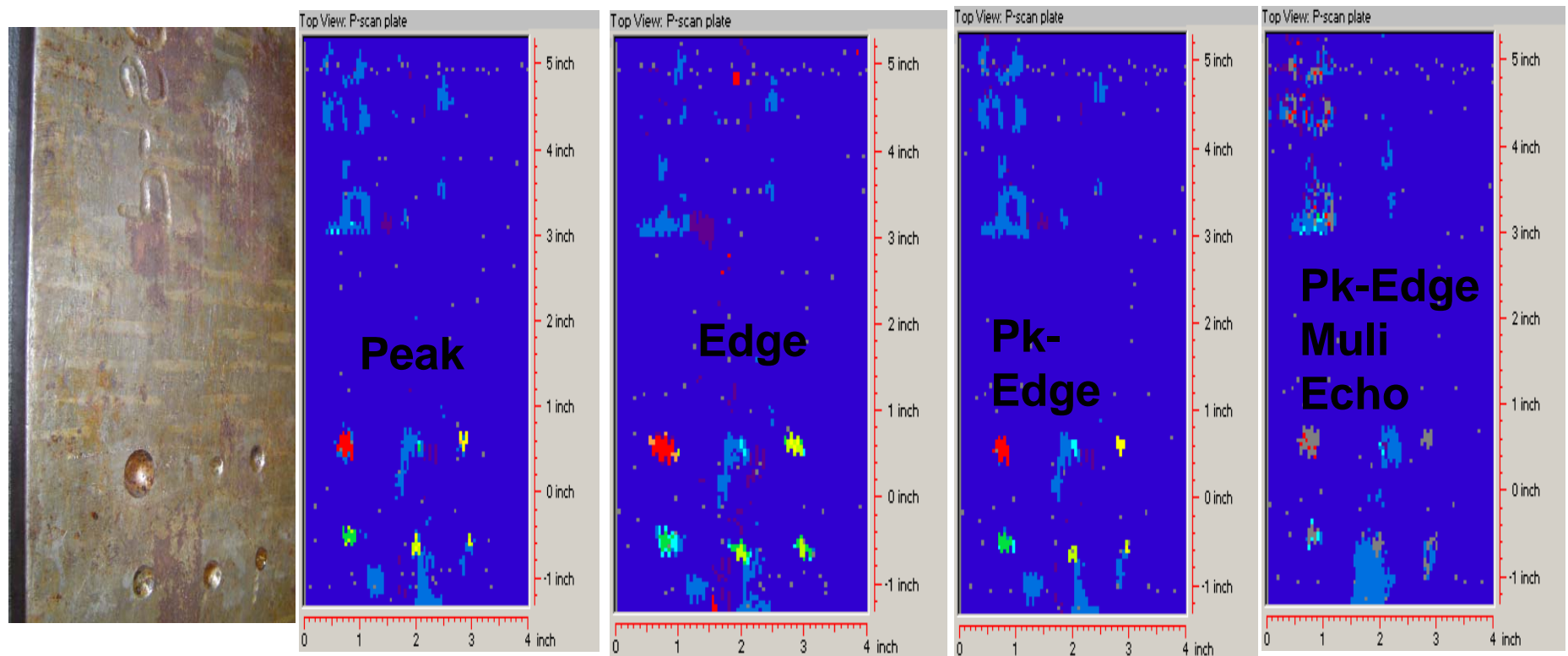
Sensitivity of thickness mapping techniques

Multiple techniques (evaluation methods)
calibrated individually

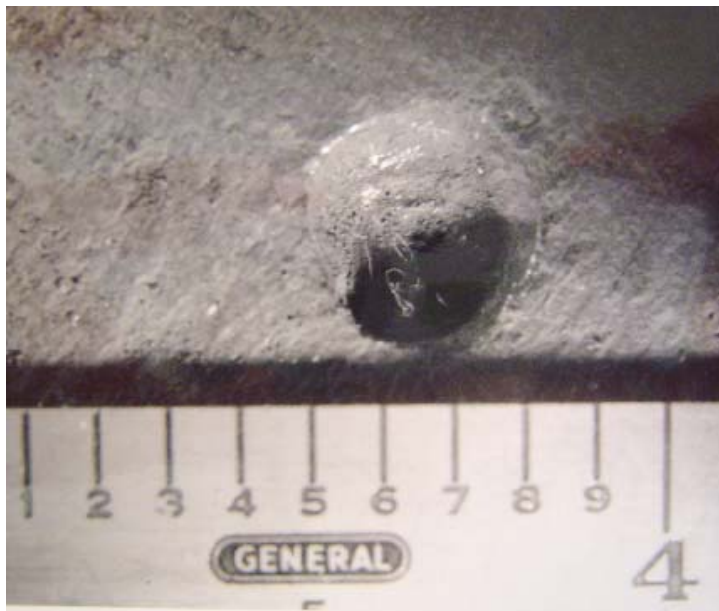
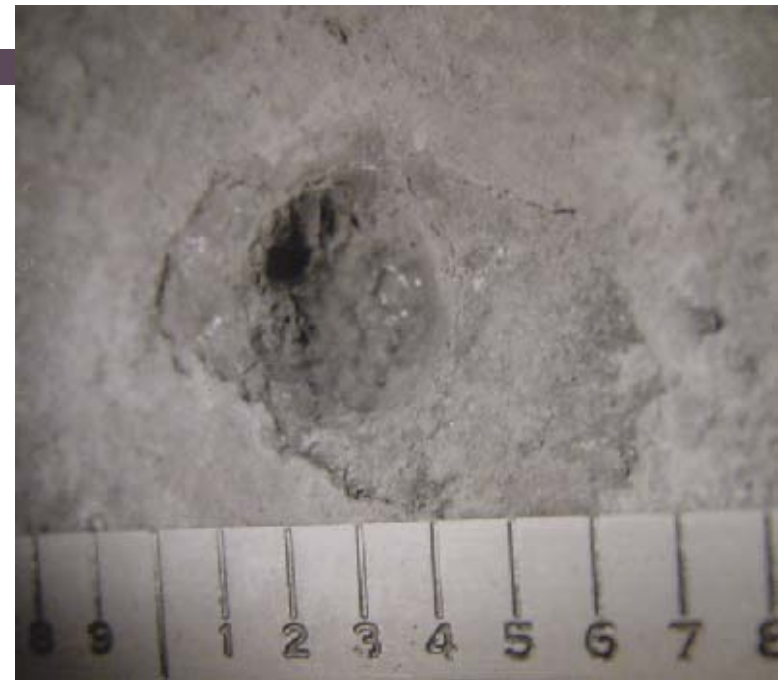
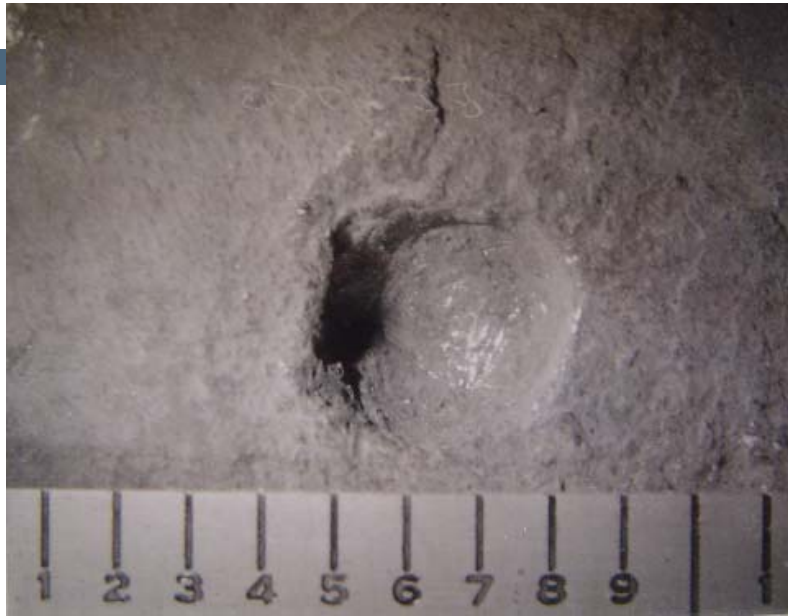


Evaluation method comparison

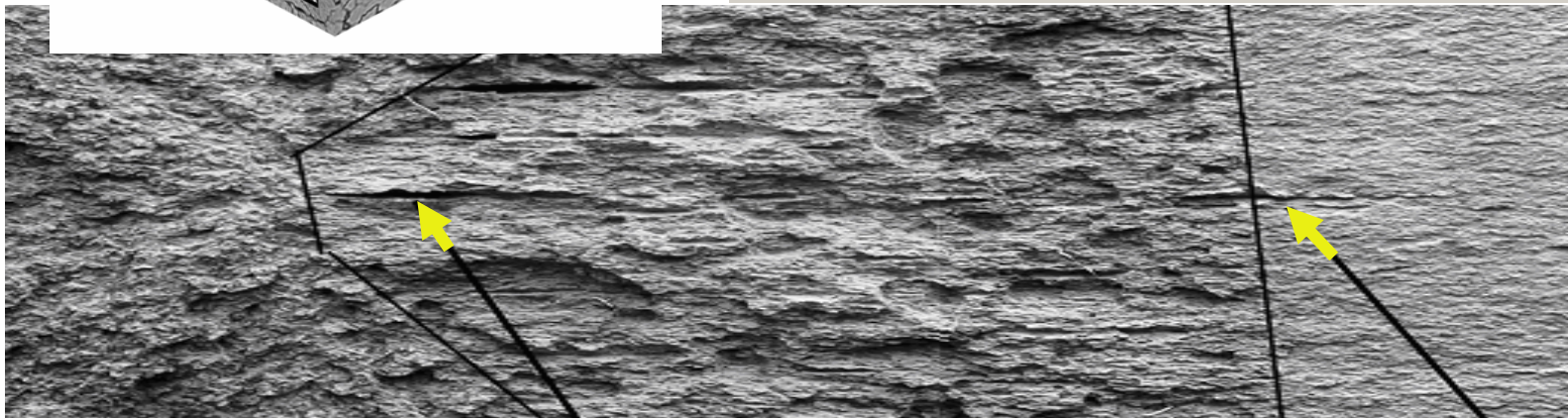
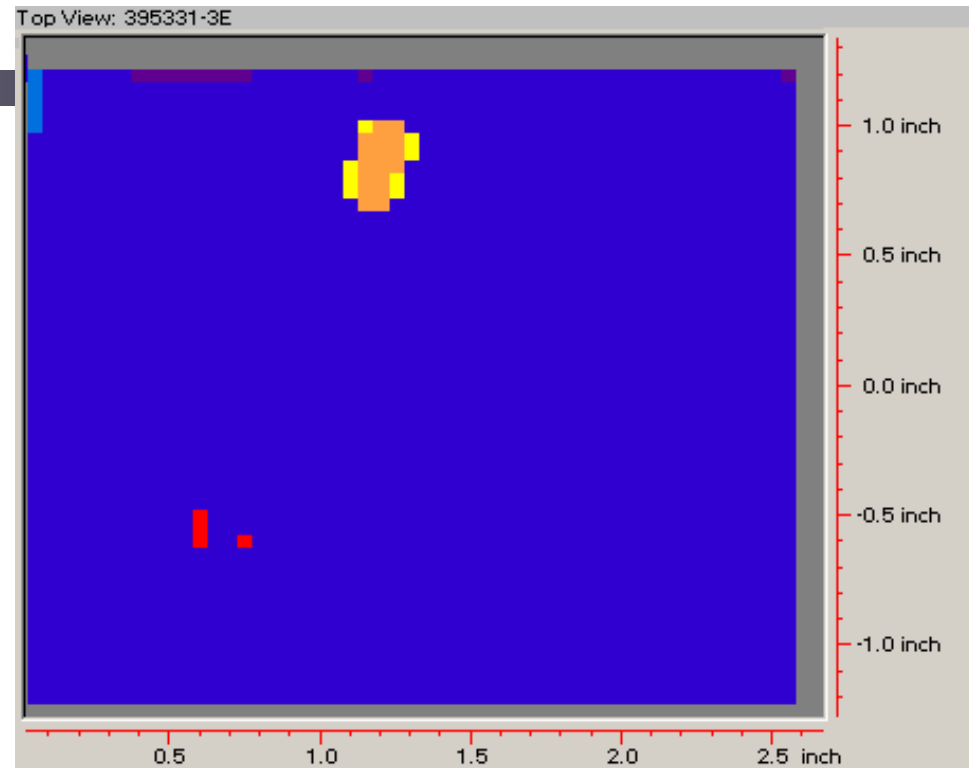
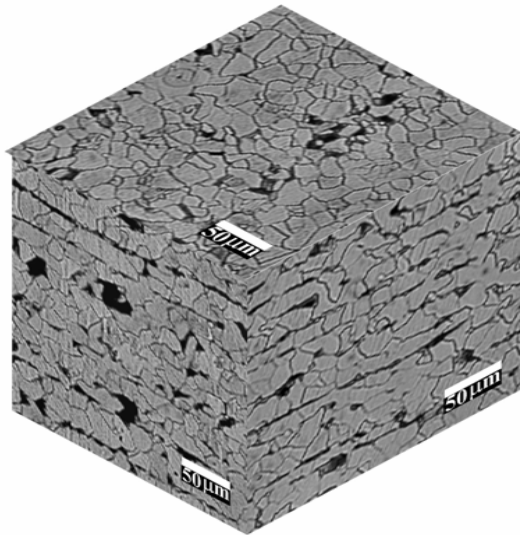
Images of 4 methods collected simultaneously from hemispherical pits



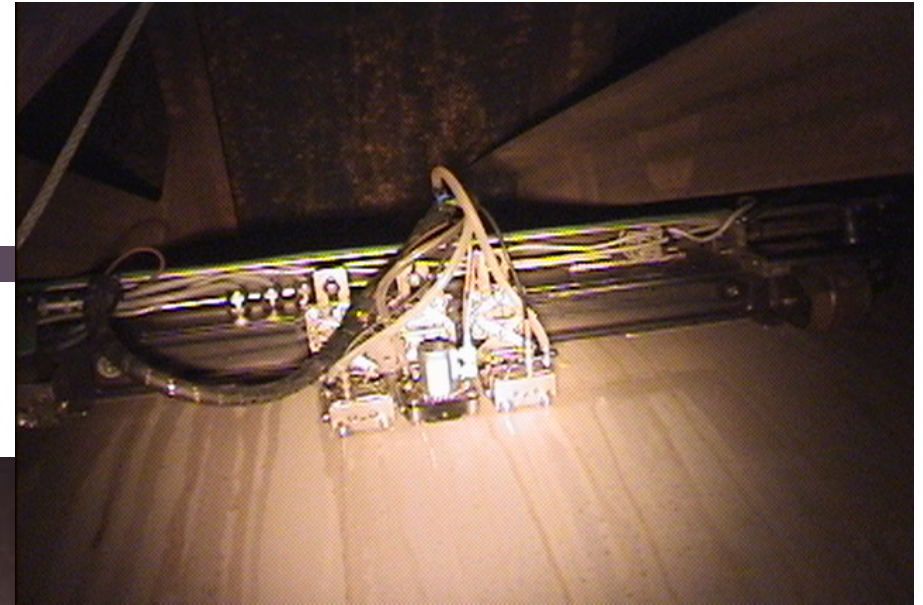
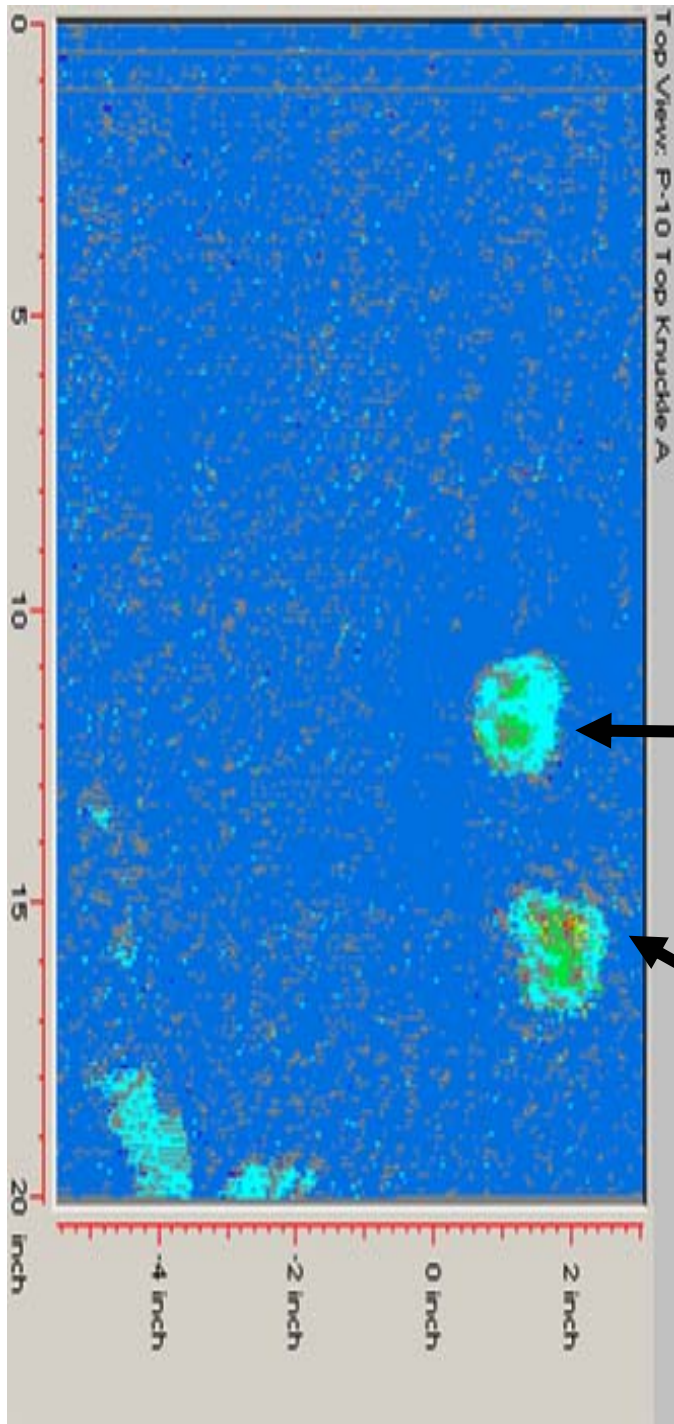
Actual Pre-Service Pit Examples (scale 0.10 inch)



Metallographic and Ultrasonic Results Showing Impurities in Steel.



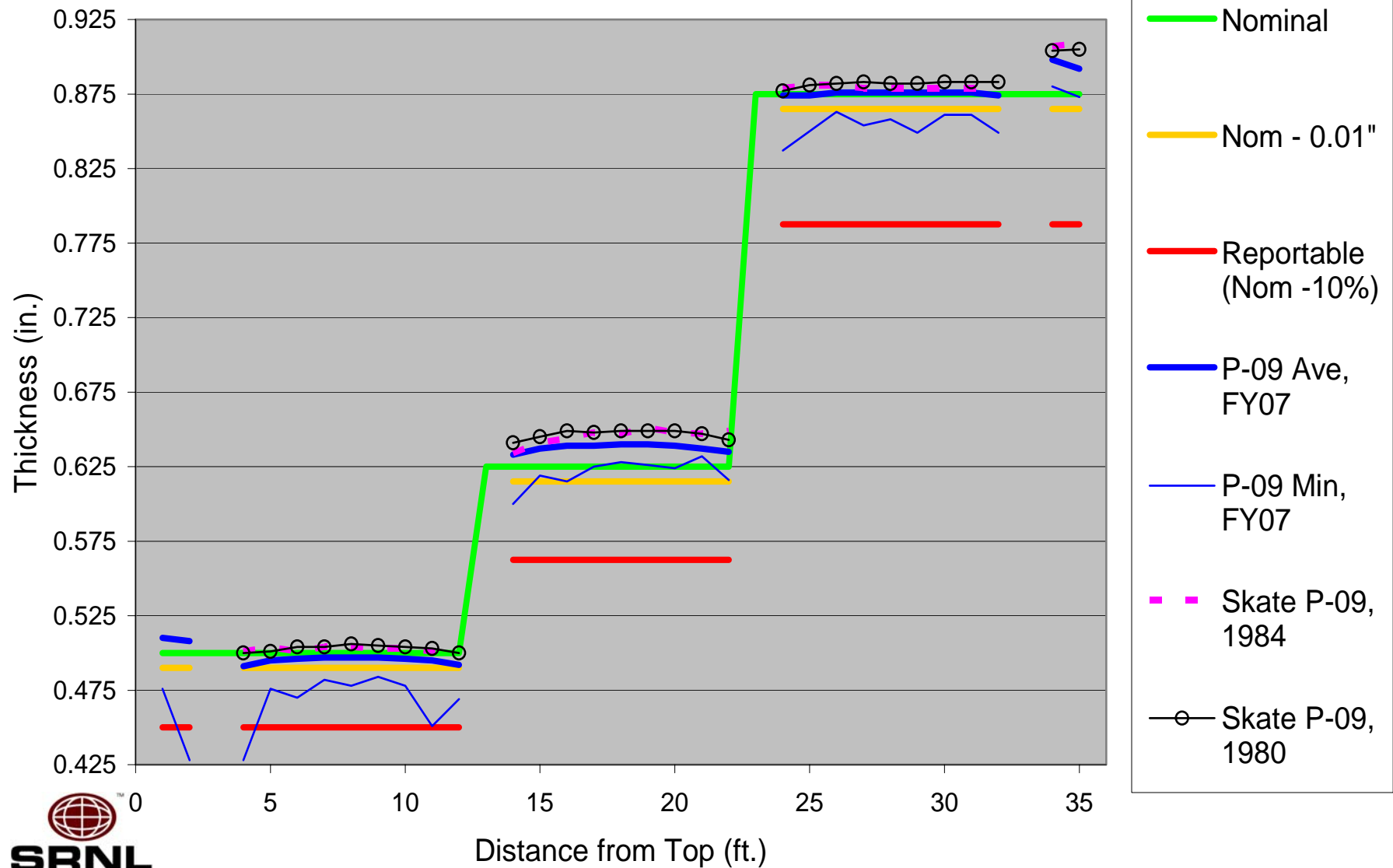
SRNL



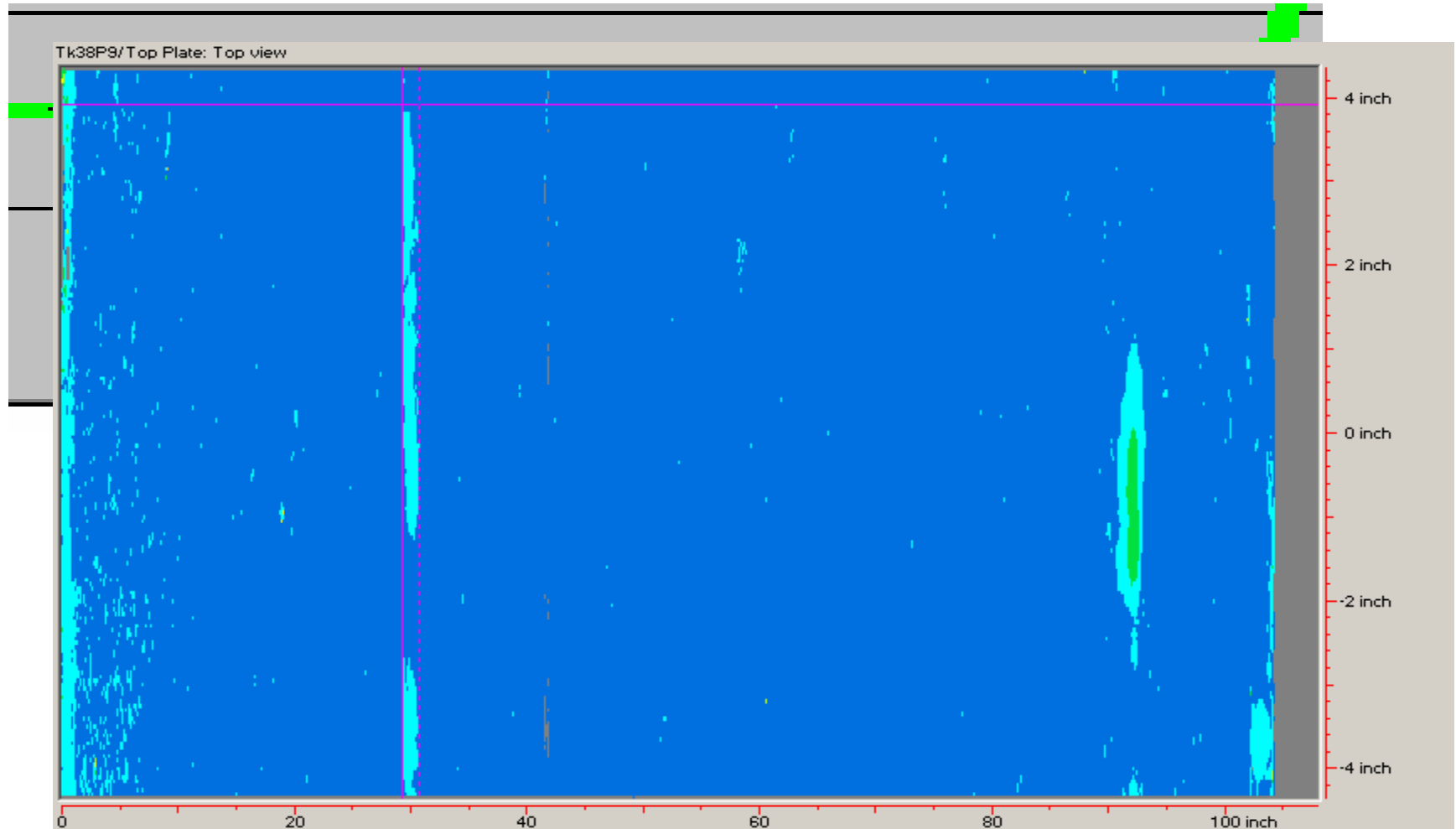
Fabrication
Artifacts – OD
Grinding areas
that were painted
over prior to
going into
service.

27 years of UT thickness data

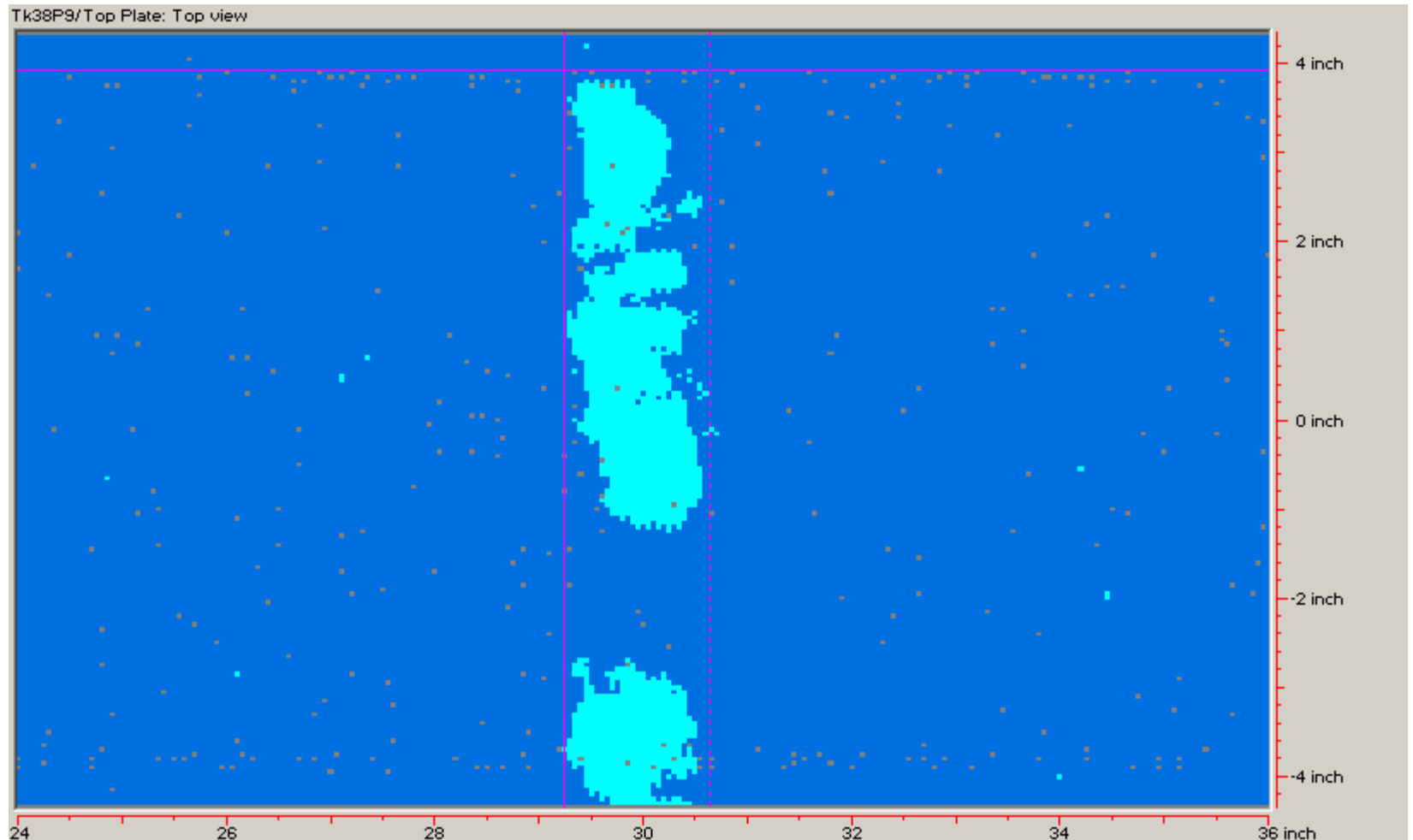
Tank 38 Riser P-09 1980 & 1984 Skate vs. FY2007



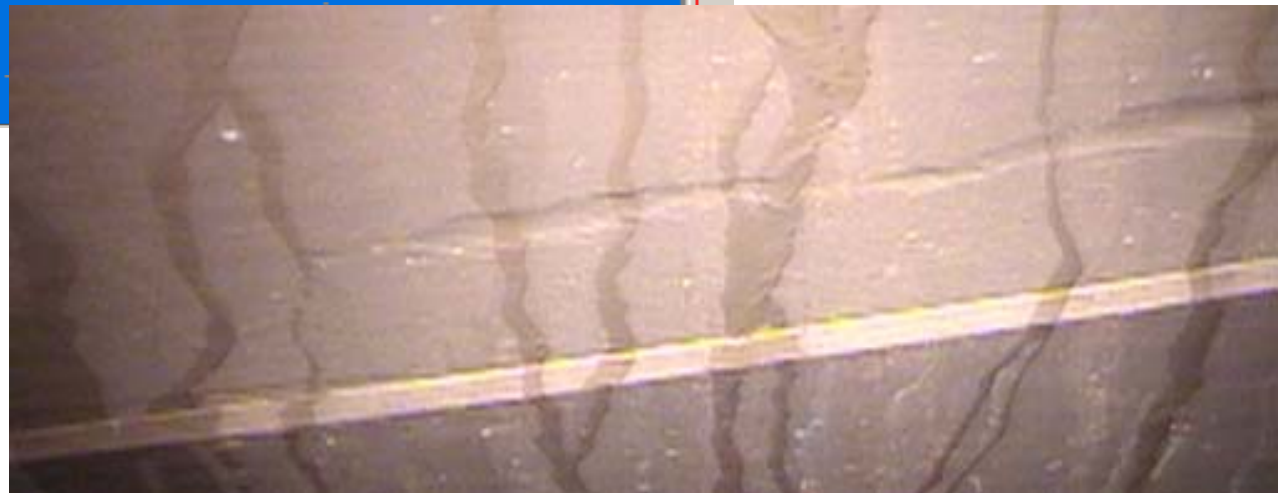
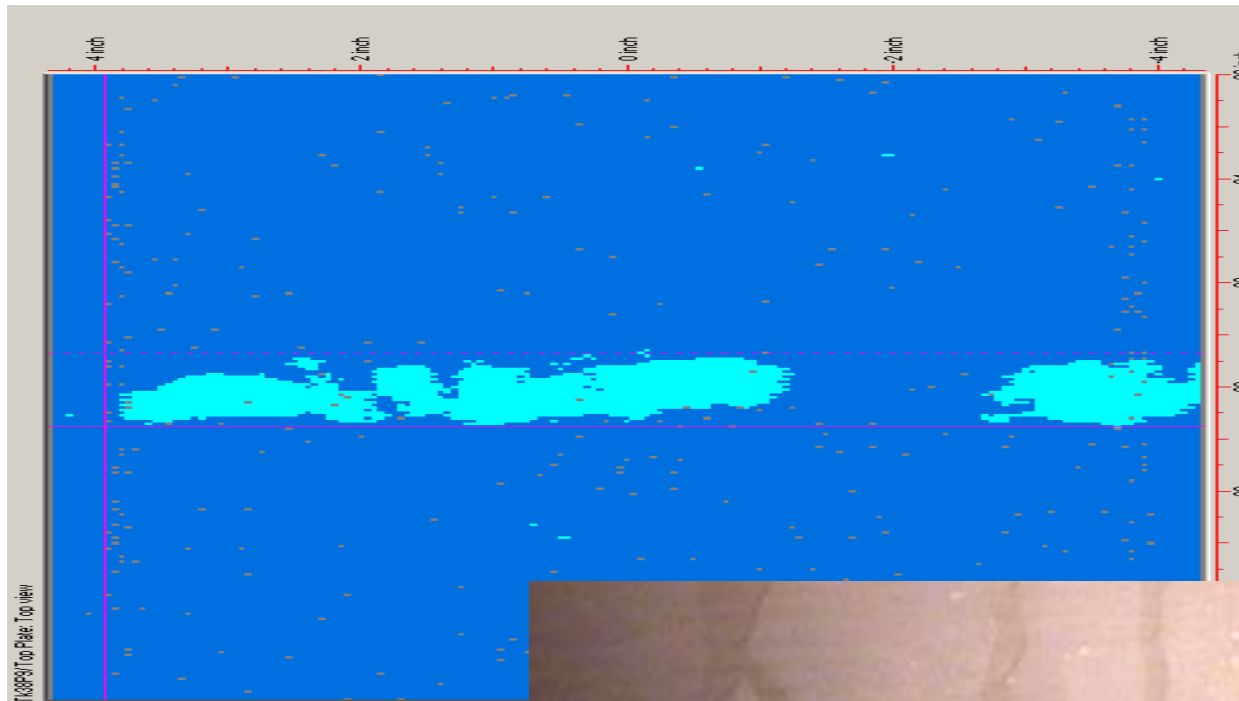
Tank 38, Riser P-9, top plate. Indications on inside surface.
Horizontal line, 30" below top knuckle weld.



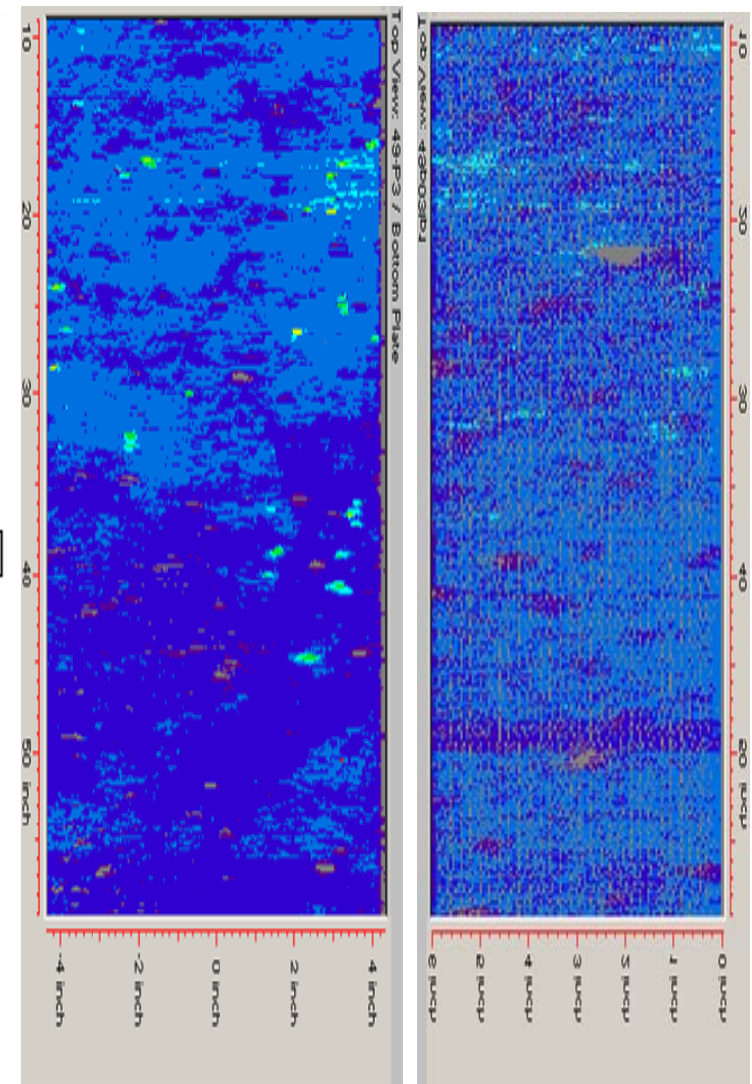
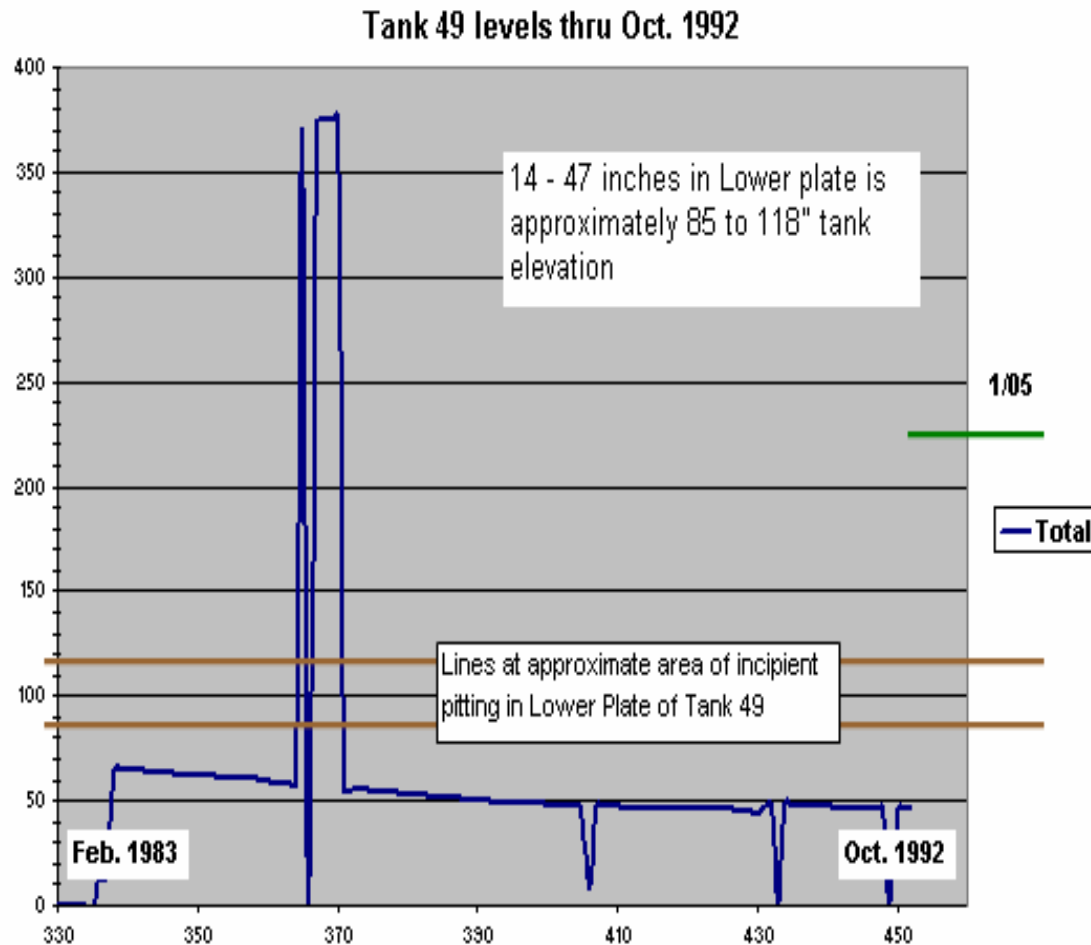
Indications on inside surface top plate Tank 38.
Horizontal line, 30" below top knuckle weld



Indications on inside surface of top plate in Tank 38 are similar to fabrication artifact in top plate of Tank 41



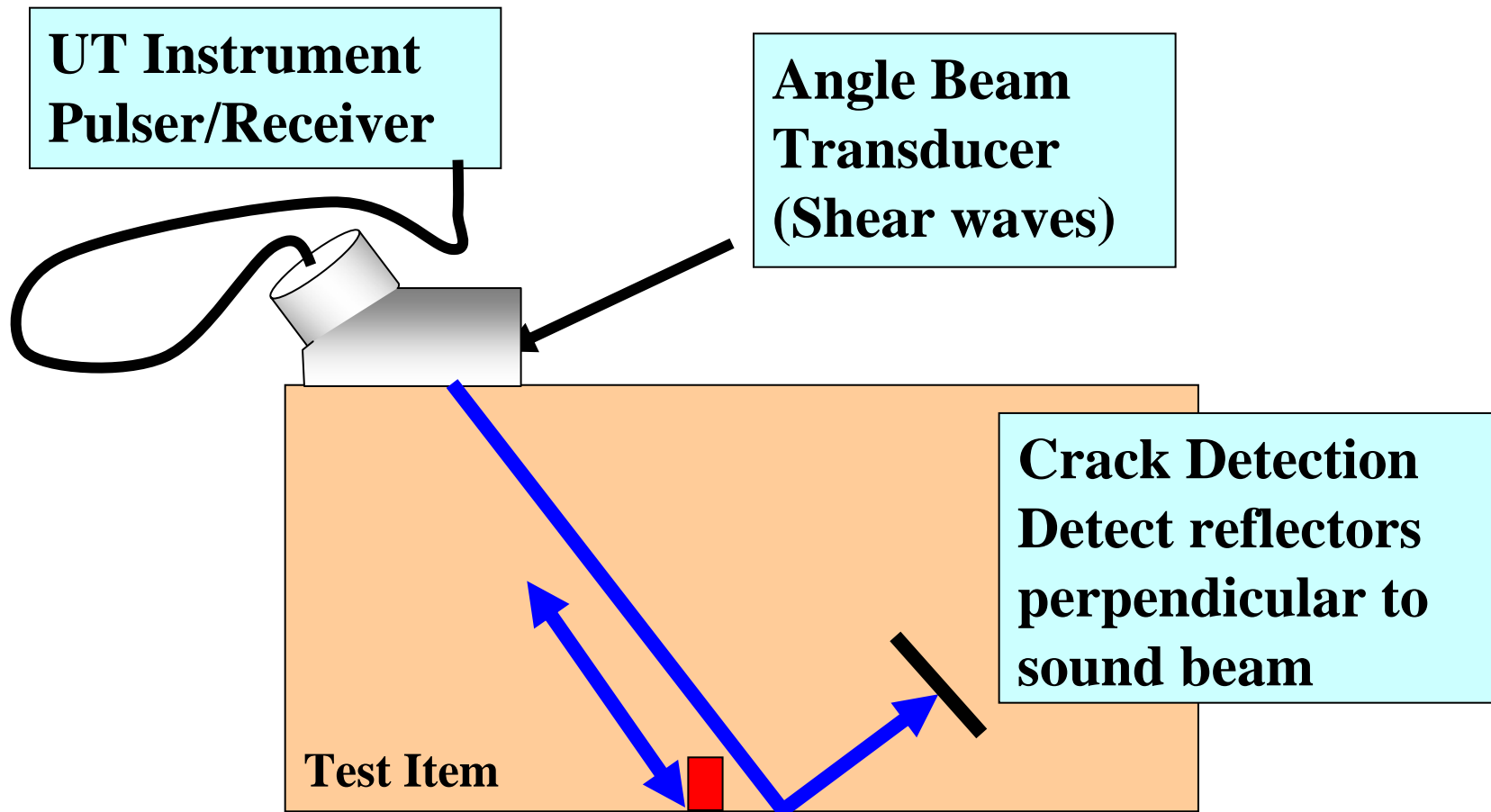
Incipient Pitting, Tank 49, Riser P-3, Lower Plate Estimated Liquid Level, P-scan Data from 1995 & 2004



Tank 15 Inspection Summary

Tank 15, a Type II, non-stress relieved waste tank was also inspected this fiscal year as part of the ISI program. The same examination techniques were used on Tank 15 as on the Type III tanks. Tank 15 has been out of service due to leakage from stress corrosion cracking (SCC). Inspections were performed to validate known corrosion models and determine if crack growth occurred since the previous examination five years ago. Several cracks were found to have increased in length perpendicular to the weld seam.

Angle Beam / Crack Detection

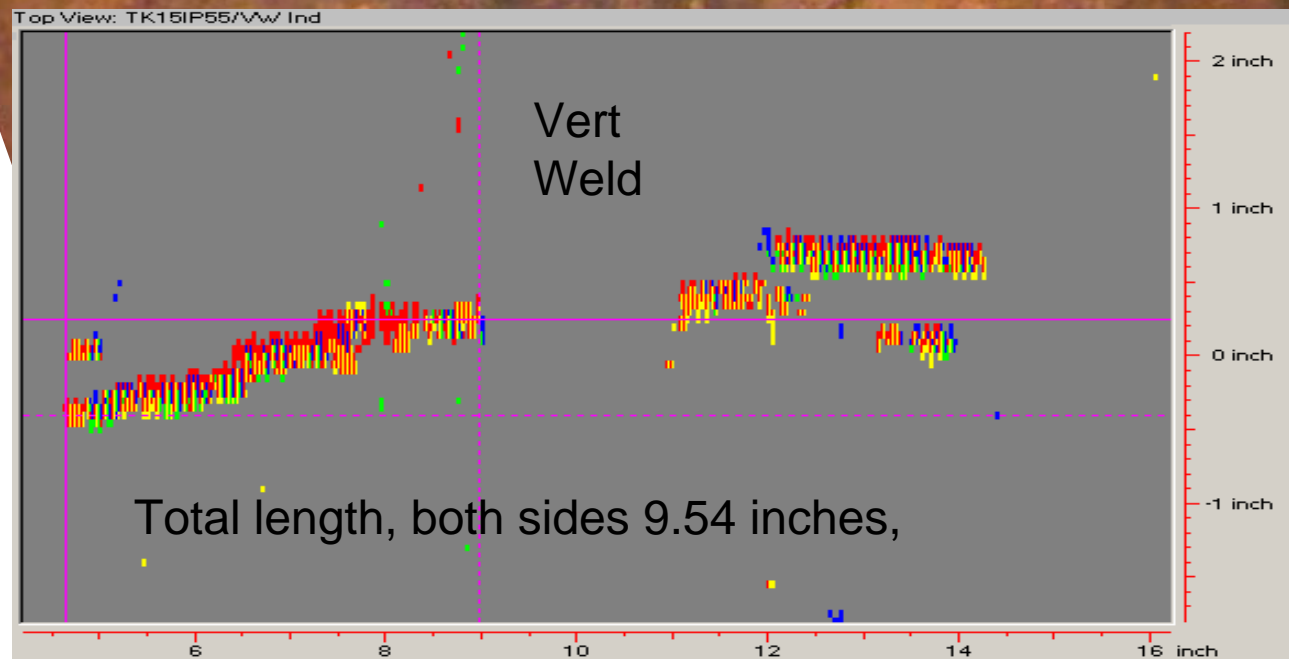


Tank 15, Vert Weld

Picture of crack area prior to scan
and data from P-scan inspection of
same area. Both from 4/24/07

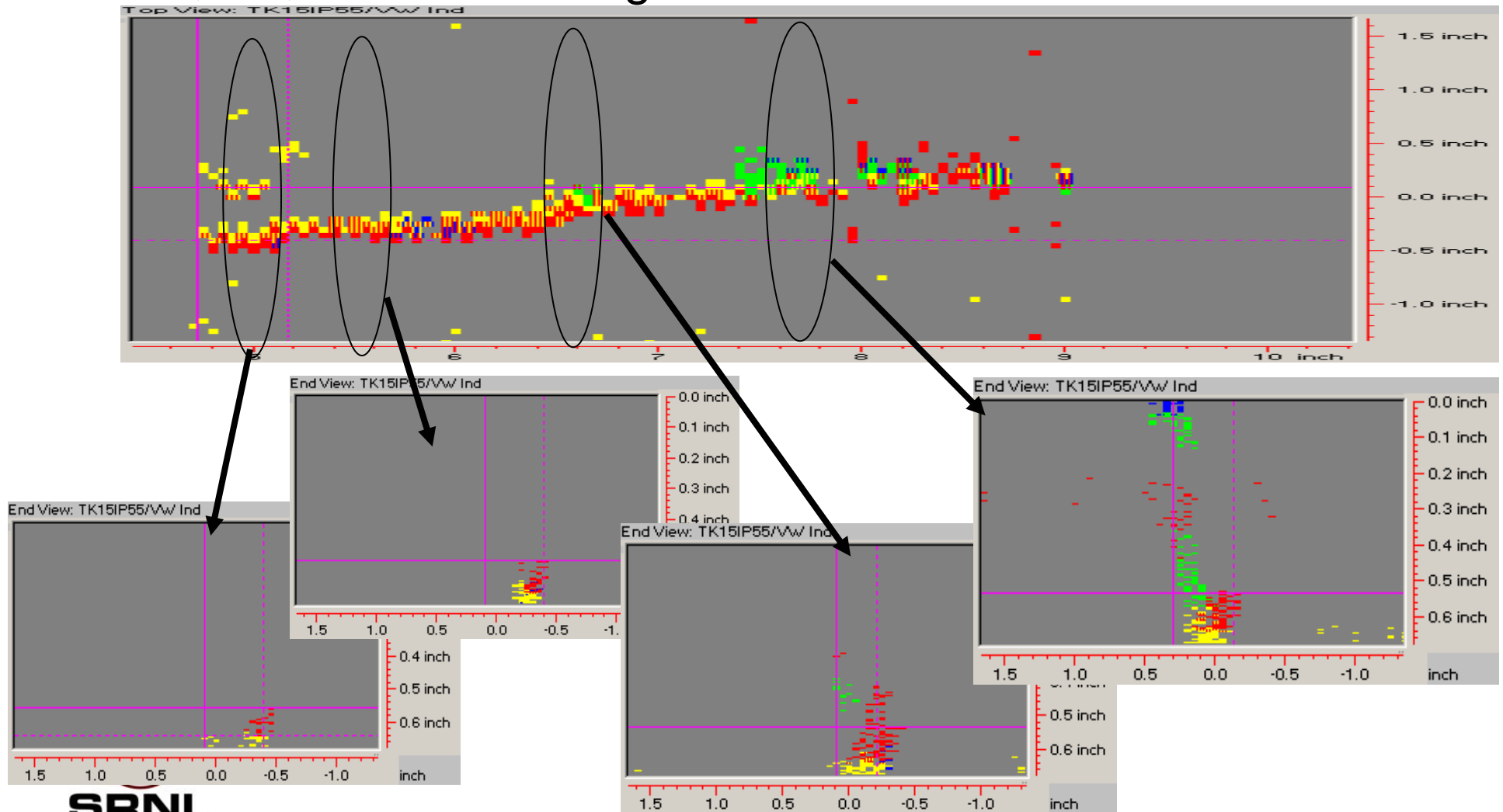


2002
Indication
number 1



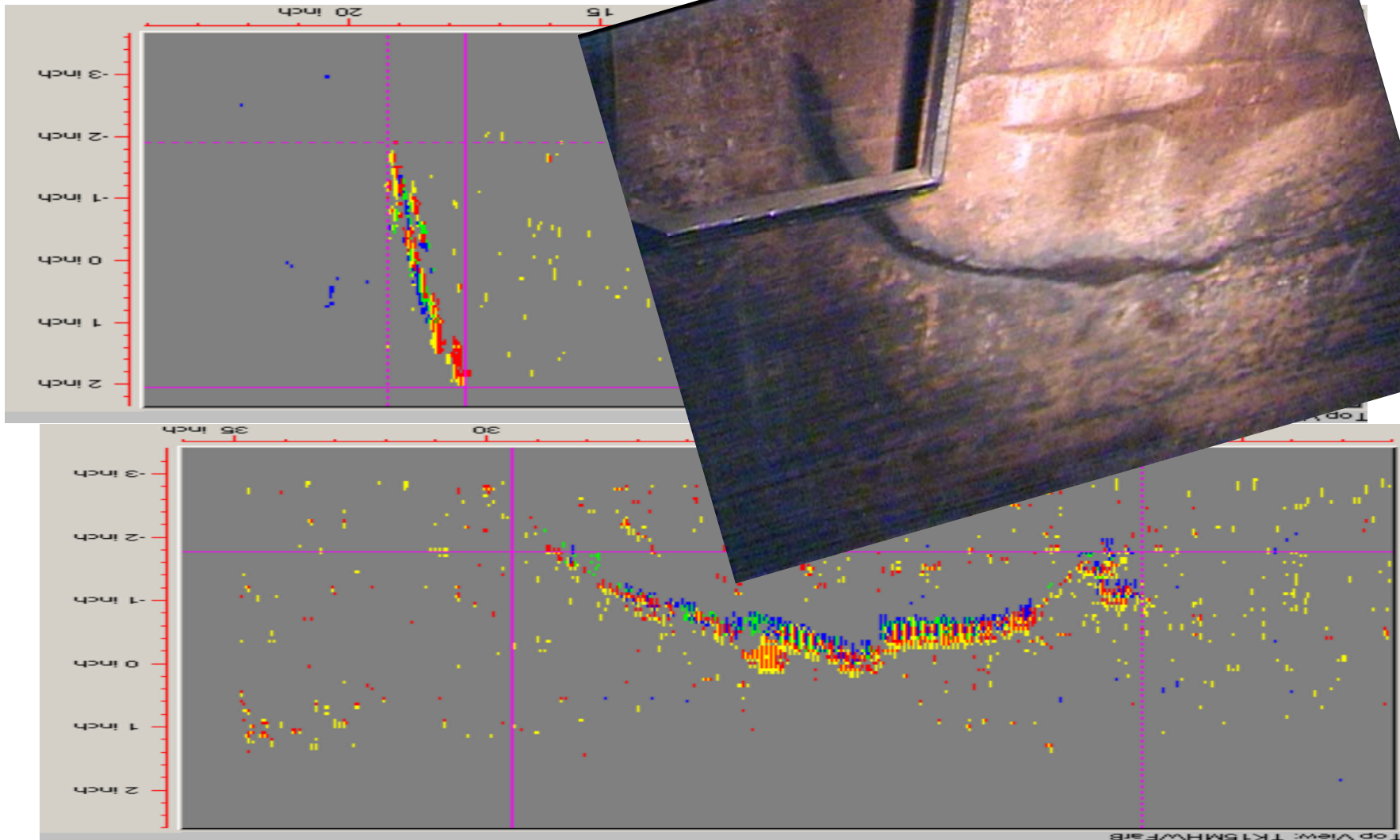
End View slices showing depth along crack

↔ Increased length 0.46"



2002
Indication
number 10

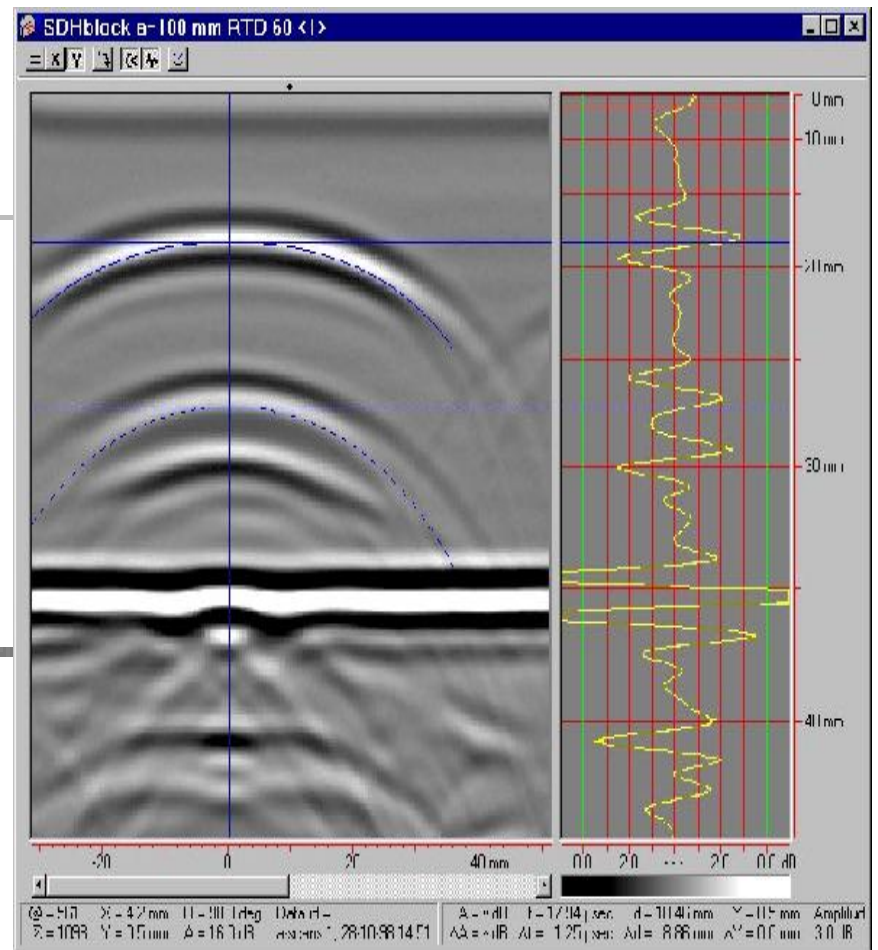
Tank 15 Middle Horizontal Weld Indication at repair weld @ 207'



Detail of Tank 15 crack @ 207' as found in 2007

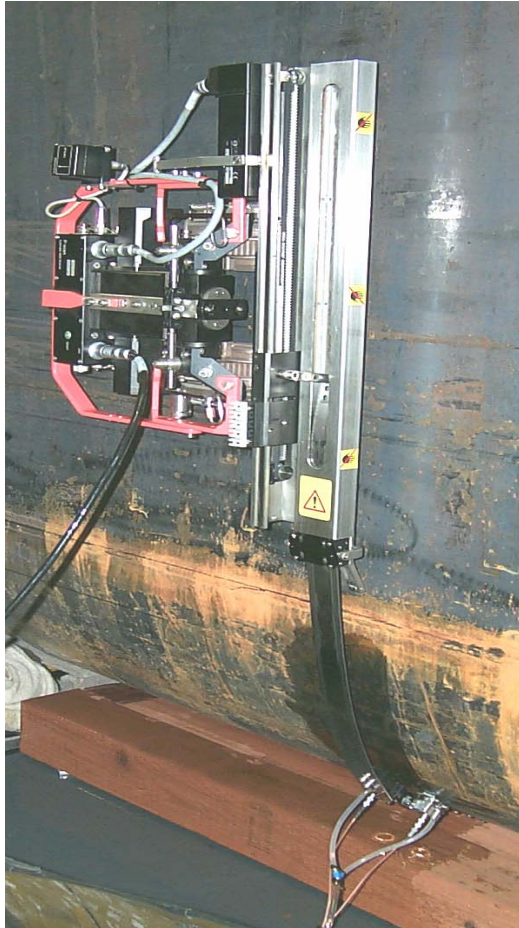


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P-scan Knuckle Arm

Novel approach to inspecting curved section of bottom knuckle



Increases inspection coverage with conventional UT techniques



Future Work – Waste Removal



Future Work – Waste Removal

